Remarks

Claims 143-155, 167-193 and 196-224 are pending.

Rejection of Claims under 35 U.S.C. §§ 102(b)/103(a)

The Examiner maintains the rejection of Claims 143-145, 147, 149-155, 167-193, and 196-202 as anticipated by USP 5,483,094 (Sharma). The Examiner also rejected product-by-process Claims 203-223 as anticipated by or obvious over Sharma. The Examiner rejected Claims 146 and 148 as obvious over Sharma. These rejections are respectfully traversed.

First of all, in response to Applicant's arguments, the Examiner argued that the "plane surface" between 32/33/34 reads on the claim limitation of the term "faceted surface." The Examiner asserts that "faceted surface" must be interpreted as "a small plane surface," stating as follows (Office Action at page 9, emphasis added):

> Furthermore, the Applicant argues that the claimed 'faceted' has a plane orientation. It is well settled that, during examination proceedings, claims are given their broadest reasonable interpretation and *a claim must be read in accordance with the percepts of English grammar and words should be give their plain, ordinary meaning.* In re Hyatt, 708 F2d 712, 218 USPI 195 (Fed. Cir. 1983). *In this case, 'faceted' would be interpreted as 'a small plane surface';* thus the plane surface between layer 32/33/34 would read on the claimed limitation. Although the claims are in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, ...26 USPQ2d 1057 (Fed. Cir. 1993).

The Examiner has failed to cite any basis for her definition of the term "faceted" as being "a small plane surface."

Moreover, this is not the correct and ordinary meaning of the term "faceted."

As stated in MPEP § 2111.01, "plain meaning" refers to the ordinary and customary meaning given to the term by those of ordinary skill in the art. The ordinary and customary meaning of a term may be evidenced by a variety of sources including dictionaries, and the general meanings gleaned from references sources such as dictionaries must always be in context and consistent with Applicant's use of the terms.

The Examiner is directed to the following definitions of "facet" and "faceted surface."

1) The American Heritage College Dictionary (3rd Ed.), Houghton Mifflin Co., Boston, Mass. (1997), at page 488:

> **fac•et** (făs' ĭt) n. 1. One of the flat polished surfaces cut on a gemstone or occurring naturally on a crystal...[...See FACE.] — fac'et•ed, fac' et•ed *adj.*
>
> **face** (fās) *n.* ...**8.** *Geometry.* A planar surface of a geometric solid. **9.** Any of the surfaces of a rock or crystal....

2) Webster's Third New International Dictionary, G&C Merriam Co., Springfield, Mass. (1981), at page 812:

> **[1]fac•et** ... *n.* ...**1a:** one of the small plane surfaces produced on a diamond or other precious stone in cutting... **b:** a similar surface on other material...
>
> **fac•et•ed** ... *adj.*: having or made with facets

"Facet" – as that term is known and used in the art, means a plane surface.

"Faceted" – as that term is known and used in the art, means *having facets* – that is, having *more than one* facet.

The term "faceted," as used in the claims, is in accordance with the ordinary meaning of that term. The claims recite "a faceted surface" – which, in its ordinary meaning, is a surface having multiple facets.

Second, the Examiner misstates the disclosure of Sharma at col. 3, line 42. The Examiner stated as follows in the Office Action at page 9 (emphasis added):

> 7. The Applicant argues that Sharma does not disclose each individual layer of epitaxial silicon has a faceted surface. This is not persuasive because the pillar 31 of Sharma comprises three distinct silicon layers 32, 33, and 34. *Each of the layer is being formed selectively and epitaxially* column 3 line 42...

Contrary to the Examiner's assertion, Sharma does *not* state that each layer 32/33/34 is formed selectively and epitaxially. Rather, Sharma states that the *silicon pillars* 31 are grown selectively and epitaxially. Sharma merely teaches that the *doping* within the pillars 31 can be varied to form different doped regions – designated as 32/33/34, by adjusting the relative gas flow rates.

See Sharma at cols. 3-4 (emphasis added):

> Silicon pillars 31 are selectively and epitaxially grown...Each silicon pillar 31 includes a lower doped region 32..., an central regions 33...,and an upper doped region 34...The doping within the silicon pillars may be performed using in-situ doping...
>
> In this embodiment, *the silicon pillars 31 are formed using a conventional method*. The formation may be performed by low pressure chemical vapor deposition...The lower and upper doped regions 32 and 34 are doped with an n-type dopant. The n-type dopant may be incorporated by using a gas containing an n-type dopant...The central regions 33 are doped with a p-type dopant. The p-type dopant may be incorporated by using a gas containing p-type dopant... The doping levels within regions 32-34 are determined in part by the relative flow rate between the silicon source and the dopant gas. One skilled in the art *can adjust the relative gas flow rates to obtain the desired doping concentrations*.

Sharma further states that the silicon pillars may be formed with silicon grown in the openings *and continuing* until the silicon overflows the openings. See col. 9, lines 18-21 (emphasis added):

> The silicon pillars 31 may be formed with silicon grown within the openings 72 *and continuing* until the silicon overflows the opening...

This teaches a *continuous* process to form the pillars 31 as a unitary structure – not separate deposition of separate and overlying layers as claimed in Applicant's structures.

Sharma does not teach ceasing the deposition process to form three discrete and individual epitaxial layers. Sharma merely teaches varying the doping throughout the pillar 31 to provide discretely doped regions. Those "regions" are not equivalent to Applicant's "layers."

Third, contrary to the Examiner's assertion, it would be not be inherent that each of the regions 32/33/34 of pillar 31 would have a faceted top surface.

The Examiner stated as follows (Office Action at page 9, emphasis added):

> 7. The Applicant argues that Sharma does not disclose each individual layer of epitaxial silicon has a faceted surface. This is not persuasive because the pillar 31 of Sharma comprises three distinct silicon layers 32, 33, and 34. Each of the layer is being formed selectively and epitaxially column 3 line 42. *Such epitaxial silicon layer would exhibit a strong facets on its top surface as disclosed by Liaw (4963506) in column 1 line 19-20; therefore the single crystal epitaxial silicon layers 32/33/34 would inherently having faceted surface on its top surface or the 'faceted surface' would exist between the unction of each layer 32/33/34...*

The Examiner admits that Sharma does not expressly describe overlying epitaxial layers – each having a faceted top surface. However, the Examiner maintains that it would be *inherent*

that each of the epitaxial silicon regions 32/33/34 produced by Sharma would have a "faceted" top surface. The Examiner bases that assertion on Liaw (USP 4,963,506), which generally describes epitaxial silicon as exhibiting "strong facets on its top surface" that create "a non-planar surface" (Liaw at col. 1, lines 18-23).

First – Liaw merely stated generally that epitaxial silicon has "strong facets" on its top surface. See Liaw at col. 1, lines 10-27:

> In the semiconductor art...Typically, epitaxial silicon has been used in conjunction with selective deposition. However, there are distinct disadvantages associated with the use of epitaxial silicon. First, epitaxial silicon exhibits strong facets on it top surface. These facets create a non-planar surface which is undesirable for filling contact holes since it will break the continuity of an overlay metal film....

However, it is well accepted in the art that faceted layers do not necessarily result during formation of an epitaxial silicon layer.

The Examiner is again directed to the following references (previously cited by Applicant), which clearly attest that the formation of facets does not necessarily result.

USP 6,074,478 (Method of Facet Free Selective Silicon Epitaxy) (Oguro) further attests that facet formation does *not* necessarily occur. See at col. 1, lines 28-43 (emphasis added) and FIGS. 3(a)-3(b):

FIG.3(a)

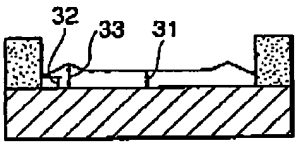
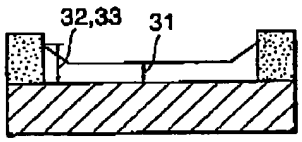


FIG.3(b)



> *...Here, FIGS. 3(a) and 3(b) are the schematic diagrams of the cross sections of the epitaxial film for the cases with and without, respectively, the formation of the facets.*
>
> ...In the case of the reference example 1, facets are formed giving a film structure as illustrated in FIG. 3(a). In contrast, in the first embodiment, a film with extremely flat structure is *formed with no facet formation*, and an increase in the film thickness at the end parts of the epitaxial film, as shown in FIG. 3(a), does not take place.
>
> ...In the case of the reference example 2, an increase in the film thickness is observed at the end parts of the epitaxial film, as shown in FIG. 3(b), *although no facet formation takes place*.

The Examiner is also directed to the following reference that further attests that facets may not be generated during growth of SEG.

USP 6,712,903 (Mask for evaluating selective epitaxial growth process) (Cheong) at col. 5. lines 33-51, bridging paragraph (emphasis added):

> The facet generation evaluation is also essential in the SEG process. The facet indicates a corner distortion generated during the growth of silicon. The facet pattern is closely connected with the process condition. That is, single crystal silicon grown by the SEG process has a different growth speed. Also, stress and interfacial energy is different according to the growth direction and insulating layer. Therefore, there is a great possibility of facet generation. According to the present invention, the mask pattern for facet generation evaluation comprises patterns of diverse form and size such as bar rotation, square-semicircular, positive block, negative block and diamond. As a result, it is possible to analyze generation of diverse facet types.
>
> *For example, a facet may not be generated during growth of SEG using LPCVD*, however, if the angle is changed, the result is also changed. In this case, the facet is evaluated by the rotating bars shown in FIG. 4A. And, facet generation by growth can be analyzed by reducing the width of bar patterns.

That a certain result or characteristic *may* occur or be present in the prior art is *not* sufficient to establish the inherency of that result or characteristic. *SmithKline Beecham Corp. v. Apotex Corp.*, 74 USPQ2d 1396 (Fed. Cir. 2005); *Continental Can Company USA v. Monsanto Company*, 20 USPQ2d 1746 (Fed. Cir. 1991); *In re Oelrich*, 212 USPQ 323, 326 (CCPA 1981). In relying upon the theory of inherency, the Examiner must provide factual and technical grounds to support the determination that the allegedly inherent characteristic *necessarily and inevitably* results from the applied prior art. Inherency may not be established by probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient.' *In re Robertson*, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999)

For the doctrine of inherency to apply it must be *inevitable* that Sharma's process *necessarily* results in *discrete* overlying epitaxial *layers* – with each layer having a "*faceted top surface.*"

The Examiner has provided no evidence or reasoning that Sharma's process would *necessarily and inevitably* result in an epitaxial layer having a faceted surface. Nothing in either Liaw or Sharma supports the Examiner's allegation that each of the doped regions 32/33/34 are separate and individually formed layers – or that a faceted surface would necessarily form between the junction of each region 32, 33, 34.

Regarding product-by-process Claims 203-223, the Examiner stated as follows at page 7 (emphasis added):

> Regarding claims 203-223, as discussed in the above claims 143, 149, 173, 176, 179, 182, 186, 190, 196, 197-202, Sharma *discloses the all the claimed structure limitations* in claims 203-223. Claims 203-223 are product-by-process, thus all the process limitations in claims 203-223 do not carry weight in a claim drawn to structure. In re Thorpe, 277 USPQ 964 (Fed. Cir. 1985).

To achieve a faceted top surface as in Applicant's structure – each of the regions 32/33/34 must be formed *individually and discretely* – *not* as a continuous process. However, Sharma used a *conventional* deposition process, and further indicated that the process was a *continuous* process – and merely altered the doping regimen during formation of the pillars 31.

Applicant's process limitations distinguish the claimed product over the prior art. Accordingly, those process limitations must be given the same consideration as traditional product characteristics. *In re Luck*, 177 USPQ 523, 525 (CCPA 1973); *In re Hallman*, 210 USPQ 609, 611 (CCPA 1981).

By Applicant's process, individual epitaxial layers are formed – with each layer having a faceted (more than one facet) surface. The *formation of an insulating layer* over an epitaxial silicon layer – *and then removing a portion of the insulating layer from the top surface of the layer* – then forming another epitaxial silicon layer on the underlying layer — *and then depositing another insulating layer* – distinguishes Applicant's structure from the prior art.

According to the process steps recited in Applicant's product-by-process claims:

- a first *faceted* epitaxial silicon layer is grown;
- an *insulative layer is deposited* over the first epitaxial layer;
- the insulative layer is removed from the top surface of the first epitaxial layer;
- a second *faceted* epitaxial silicon layer is grown on the first epitaxial layer;
- an *insulative layer is deposited* over the formed structure, now having two epitaxial layers.

Thus, an embodiment of a device resulting from that process will have the following structural elements:

— Each of the layers with a faceted top surface.

— The lower (first) epitaxial layer having a *thicker* insulating sidewall layer than the upper (second) epitaxial layer.

By comparison, Sharma forms a pillar *within an opening (22)* in an insulating layer. A conventional process as used by Sharma would *not* produce Applicant's device as claimed.

Applicant has demonstrated that the insulating layer forming steps and the facet forming steps in Applicant's process results in a distinct difference in structure from that described by Sharma. In the instant case, the process steps of Applicant's product-by-process claims *do distinguish* Applicant's device over Sharma's structure.

Sharma does not teach or suggest Applicant's devices as claimed. Accordingly, withdrawal of these rejections is respectfully requested.

Rejection of Claims under 35 U.S.C. §103(a)

The Examiner rejected Claim 224 as obvious over Sharma in view of USP 5,849,077 (Kenney). This rejection is respectfully traversed.

The Examiner contends that the epitaxial layer 19 of Kenney has the same (100) plane orientation as the silicon substrate 1.

Claim 224 depends from Claim 143, and recites that the faceted top surfaces of each of the epitaxial silicon layers defines a facet having a (100) plane orientation. The disclosure of Kenney does not make up for the deficiencies of Sharma in teaching or suggesting Applicant's devices as claimed.

Accordingly, withdrawal of this rejection is respectfully requested.

Extension of Term. The proceedings herein are for a patent application and the provisions of 37 CFR § 1.136 apply. Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that Applicant has

inadvertently overlooked the need for a petition for extension of time. If any extension and/or fee are required, please charge Account No. 23-2053.

Based on the above remarks, the Examiner is respectfully requested to reconsider and withdraw the rejections of the claims. It is submitted that the present claims are in condition for allowance, and notification to that effect is respectfully requested.

Respectfully submitted,

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